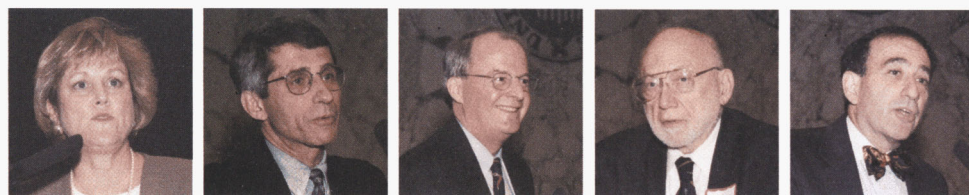


Congressional Briefing



Infectious Disease Threats

As We Enter the New Century: What Can We Do?



AMERICAN
SOCIETY FOR
MICROBIOLOGY

Infectious Disease Threats

As We Enter the New Century: What Can We Do?

Infectious diseases are the leading cause of death worldwide and the third leading cause of death in the United States. As the new century begins we are challenged by newly emerging infections and the decreasing effectiveness of our antibiotic arsenal. On June 21, 1999 the American Society for Microbiology held a special briefing in the Senate Hart Office Building. The briefing included presentations by some of the nation's most eminent researchers. They discussed threats from infectious diseases and biological terrorism as well as research and strategies to detect, treat and control the resurgence of infectious diseases.

SPEAKERS:

Joshua Lederberg, Ph.D.
Nobel Laureate
Rockefeller University
The Bugs vs. the People: the Evolutionary Race

Stuart Levy, M.D.
Director, Center for Adaptation Genetics and
Drug Resistance
Tufts University
Antibiotic Resistance: Microbes on the Defense

Gail Cassell, Ph.D.
Vice President, Infectious Diseases, Drug Discovery
Research and Clinical Investigation
Lilly Research Laboratories
Causal Links of Infectious Agents in Cancer,
Arthritis and Other Chronic Diseases

Anthony Fauci, M.D.
Director, National Institute for Allergy and Infectious Diseases
National Institutes of Health
The Importance of Global Health Research

James Hughes, M.D.
Director, National Center for Infectious Diseases
Centers for Disease Control and Prevention
Public Health Strategies for Addressing
Emerging Infections

Introduction

The outlook for infectious diseases has changed remarkably during the twentieth century. Much of this period was marked by steady progress in preventing and controlling a wide range of troubling, many of them deadly, diseases. Increasingly effective public health measures, broadened use of a growing number of vaccines, and the judicious application of powerful and ever more sophisticated antimicrobial drugs have contributed in a major way to curbing the toll in human lives and suffering that infectious diseases can exact.

Put simply, there is no more smallpox or polio to worry about, little anymore in the way of measles and rubella, and many other infectious diseases that can give rise to such life-threatening conditions as meningitis or bouts of pneumonia can be satisfactorily treated with effective antibiotics.

Yet, despite this remarkable progress, infectious diseases remain the leading cause of death worldwide and the third leading cause of death in the United States. Moreover, the past few decades have brought new challenges in this arena, including new and reemerging

diseases, such as AIDS, tuberculosis, malaria, Legionnaires' disease, and deadly infections caused by a rodent-borne Hanta virus; the appearance and spread of antibiotic resistance; and the growing realization that microorganisms seem to be at least partly responsible for causing a surprising number of chronic diseases.

These are but a few of the unsolved problems that microorganisms continue to pose for public health officials, physicians, and microbiologists as they look ahead to the next century. With such challenges in mind, the American Society for Microbiology (ASM) convened a special briefing for Congress, staff members, and Administration officials on June 21, 1999, "Infectious Disease Threats as We Enter the New Century: What Can We Do?"

During the briefing, five scientific experts from both the public and private sectors outlined a number of the key infectious disease issues we are facing and suggested some of the critical steps that will be required to deal with those challenges during the century that lies ahead.

Joshua Lederberg, Ph.D.
Nobel Laureate, Rockefeller University

The Bugs vs. the People: the Evolutionary Race

Reflections on the evolutionary forces affecting interactions between people and microbes

Nobel Laureate Joshua Lederberg predicted that, even though the world is better equipped to deal with it, a major pandemic will occur sometime during the next century. Although the most likely source of that pandemic remains influenza, he said that monitoring for both it and other infectious diseases is an essential component of efforts to guard against a deadly, worldwide outbreak.

Dr. Lederberg points out that an important hallmark of pandemics and, indeed, of many smaller-scale emerging infectious diseases is that they are zoonoses—that is, they involve microorganisms that can move from one species to another. The influenza virus appears to move among humans, pigs, and avian species, including chickens and ducks. During these excursions, the genes of several kinds of influenza sometimes mix and reassort, occasionally leading to highly contagious or more deadly forms. Public health officials throughout the world closely monitor influenza outbreaks for signs of just such changes. Investigative teams are in place to analyze the viruses and to prepare new vaccines to counteract them as needed.

The genetic inconstancy of influenza viruses typifies the hereditary dynamism of microorganisms. That flux is especially pronounced in the invisible occupants of the microbial kingdom. Indeed, according to Lederberg, microorganisms are frankly “promiscuous”—freely exchanging genetic materials as they adapt to changing conditions that they encounter.

This genetic promiscuity seemingly equips them to overcome the defenses of the hosts they infect. Yet, Dr. Lederberg pointed out, they do not wipe out their hosts, whether humans, animals, or plants. This paradox reflects a coevolutionary force: parasitic microorganisms in general strike a balance between aggressive

virulence, in which they threaten and sometimes irreversibly damage their hosts, and a milder state of parasitic growth, in which the parasite and host gingerly coexist.

Dr. Lederberg said that even after decades of research, microbiologists understand this balancing act rather poorly. Exploring this mystery may prove critical for developing new drugs and discovering new treatments against infectious diseases.

Germ as weapons represent another critical—and certainly far darker—side to this balancing act between human hosts and the microbes that threaten them, according to Dr. Lederberg. Whether developed for use by national governments or by independently acting terrorist groups, the threat of biological weapons raises a special set of public health concerns for experts who are charged with protecting the health and safety of military forces and civilian populations.

Much of the concern over biological weapons now focuses on their potential use by terrorist groups against unsuspecting civilian populations. Dr. Lederberg said that rogue states or smaller groups of fanatics are considered the likely source of a biological weapons-based attack.

He also pointed out that the burden of dealing with the immediate consequences of such an attack falls primarily on infectious disease specialists and other medical and public health experts—those who are charged with identifying the source of an epidemic disease, diagnosing the specific infectious agent that



was used, and treating the victims. In addition, law enforcement and national security officials will also be part of the overall response to such an incident. They are also deeply involved in efforts to prevent such attacks from occurring in the first place. Importantly, close cooperation among all these officials is a vital part of the overall defense against biological weapons.

Several bacteria and viruses head the list of potential biological warfare agents, including the pathogens responsible for causing anthrax and smallpox. After a massive vaccination program eradicated smallpox as a natural disease threat by the late 1970s, the global vaccination program was phased out. Moreover, the vaccine that protects against anthrax remains in relatively short supply and in limited use because anthrax is such

an uncommon disease. Thus, the general population is particularly vulnerable to smallpox and anthrax, both of which can be deadly when weaponized.

Such circumstances are leading microbiologists, infectious disease specialists, public health experts, and law enforcement officials to develop a broad-based, coordinated strategy for dealing effectively with the threat of bioterrorism, according to Dr. Lederberg. This strategy includes anticipating how smallpox, anthrax, and the other agents might be used for such purposes; planning for diagnosis and consequence management at the local level; adopting measures to prevent panic among the general populace; and conducting the basic and applied research that is needed to address these complex issues.

